

# LEGUMES FROM THE CENTRAL PART OF THE STATE OF CHIHUAHUA, MEXICO

A. Eduardo Estrada C. and Alfonso Martínez M.

*Facultad de Ciencias Forestales  
Universidad Autónoma de Nuevo León  
A.P. 41, 67700, Linares, N.L. MEXICO*

## ABSTRACT

Our study of the legumes from the central part of the state of Chihuahua records 42 genera and 117 species. The number of genera/number of species for each of the three leguminous subfamilies are: Lotoideae 27/77; Mimosoideae 8/28; Caesalpinioideae 7/12. Oak-pine forest had the highest number of species. Genera with the highest number of species are: *Dalea* (19), *Acacia* (11), *Phaseolus* (7), *Desmodium* (6), and both, *Senna* and *Mimosa* (5). *Dalea*, *Desmodium* and *Phaseolus* are most common on oak-pine forest communities, while *Acacia*, *Senna*, and *Mimosa* are most common on shrublands and grasslands.

## RESUMEN

Nuestro estudio de leguminosas en la porción central del estado de Chihuahua registró 42 géneros y 117 especies. El número de géneros/número de especies para cada una de las tres subfamilias es: Lotoideae 27/77; Mimosoideae 8/28; Caesalpinioideae 7/12. Los géneros con mayor número de especies son *Dalea* (19), *Acacia* (11), *Phaseolus* (7), *Desmodium* (6) y *Senna* y *Mimosa* con (5). *Dalea*, *Desmodium* y *Phaseolus* son mas comunes en los bosques de encino-pino, mientras que *Acacia*, *Mimosa* y *Senna* son mas comunes en matorrales y pastizales.

## INTRODUCTION

Legumes are constituted by three subfamilies of plants Mimosoideae, Caesalpinioideae and Lotoideae, and they are the second most diversified group of plants in Mexico after Asteraceae (Sousa & Delgado 1993). Legumes are found in all plant communities of the country, and are one of the dominant groups of plants in north Mexico. They are found on several types of shrublands of Nuevo Leon and Chihuahua (pers. obs.).

The study area covers 7500 km<sup>2</sup>, is located at 28° 15'–29° 05' N, 105° 07'–107° 35' W, and includes the eight municipios, Aldama, Aquiles Serdan, Chihuahua, Coyame, General Trias, Julimes, Meoqui and Riva Palacio on a surface of 7500 km<sup>2</sup> (Fig. 1). The study area includes two physiographic provinces (Anónimo 1987), the eastern part of the Sierra Madre Occidental and Sierras y Llanuras del Norte, which has two subprovinces, Bolson de Mapimi and the Sierras Plegadas del Norte. Most rocks are sedimentary or volcanic origin from the Quaternary Period. Most mountains in the area are acidic intrusive igneous rocks from Tertiary Period and metamorphic rocks (limestone) outcrops from the Mesozoic Era, and from the Lower Cretaceous Period (Anónimo 1981). The three main climate types for the area are: (1) very dry semi-warm, characterized by summer rains, the winter rainfall less than 5% of total, the winter cool—characteristic of western part of



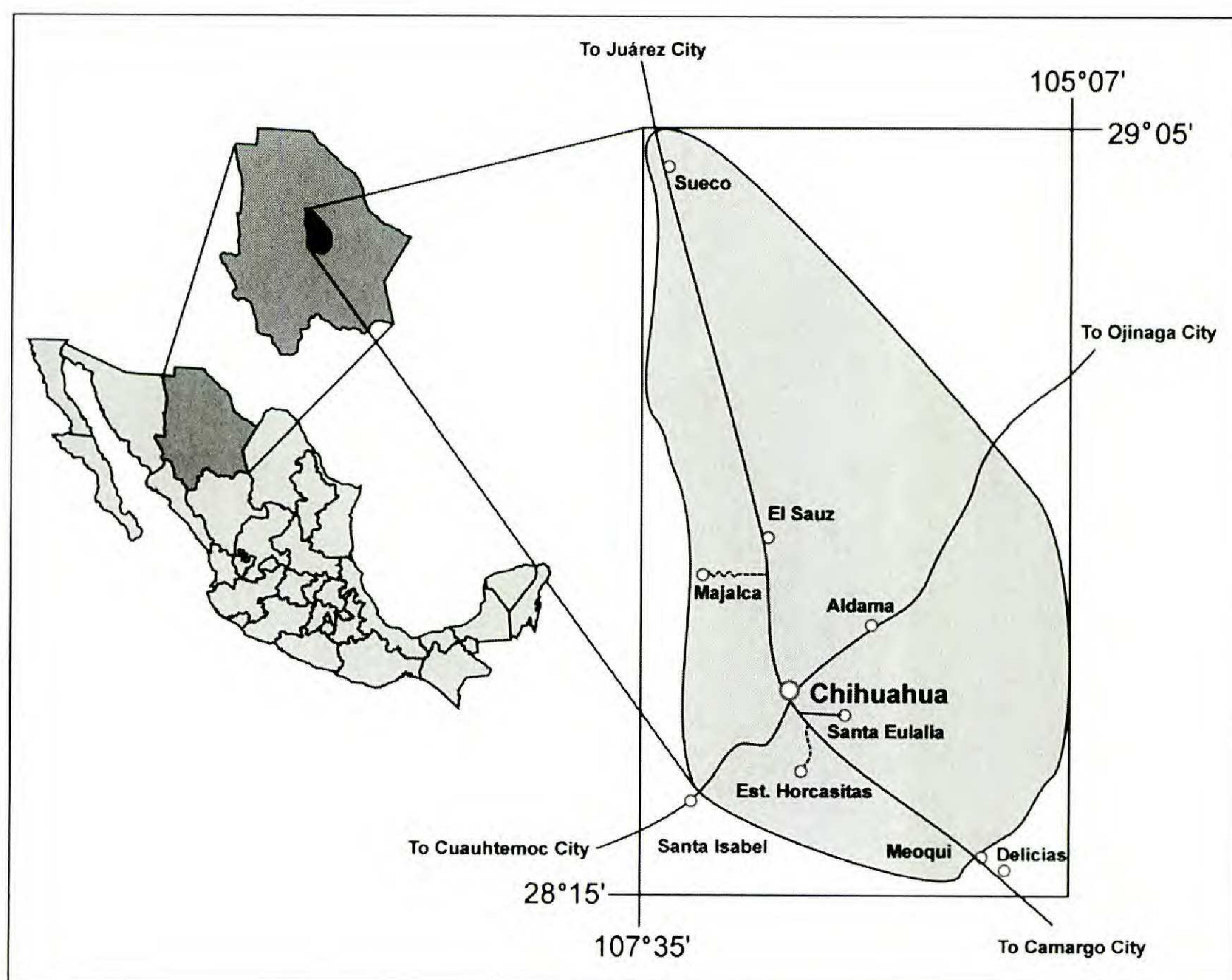


FIG. 1. Map showing study area.

study area, (2) dry, temperate, with summer rains, winter rainfall less than 5% of total, summer warm—occurring as a N-S-oriented 30–40 km wide strip in central part of study area; (3) Semi-warm, semidry temperate, with summer rains, the winter ranges 5–10.2% of total, summer warm—found on high plains and small mountains ranges at 1600–2400 m elev. These climatic types are mapped as BWhw(w), BSokw(w) and BS<sub>1</sub>kw, respectively, in Garcia (1973).

There are three main vegetative communities, grasslands, shrublands and oak-pine forest (Rzedowski 1978). *Bouteloua*, *Sporobolus*, and *Hilaria* are the dominant genera in the grassland landscape, *Bouteloua gracilis* Lag, *B. curtipendula* (Michx.) Torr., *B. eriopoda* (Torr.) Torr., *B. hirsuta* Lag., *Sporobolus airoides* (Torr.) Torr., *Hilaria mutica* (Buckl.) Benth., *Eragrostis intermedia* Hitchc., *E. lehmaniana* Nees, *Enneapogon desvauxii* Beauv., and *Lycurus phleoides* H.B.K., are the dominant grassland species found. Shrubland communities have mostly low elements, seldom over 2.5 m tall, forming subthorn shrublands (Anónimo 1981), where *Larrea tridentata* (Sess. & Moc. ex DC.) Cav., *Flourensia cernua* DC., *Acacia neovernicosa* Isely, *A. constricta* Benth., *A. schaffneri* (Wats.) Herm., *Lycium berlandieri* Dun., *Koeberlinia spinosa* Zucc., *Condalia ericoides* (A. Gray) M.C. Johnst., *Yucca elata* (Engelm.) Engelm., *Opuntia* spp., *Mimosa* spp., *Celtis pallida* Torr., *Parthenium argentatum* Gray and *P.*



*incanum* Kunth are the predominant species (Anónimo 1978). Oak-Pine forests are located in mountain areas, north of Cd. Chihuahua, especially Sierra El Nido and Parque Nacional Cumbres de Majalca, and 30–40 km west of Cd. Chihuahua in direction to Cd. Cuauhtemoc. *Quercus-Juniperus* and *Pinus-Quercus* associations are present; most common oak species are *Quercus chihuahuensis* Trel., *Q. grisea* Liebm. and *Q. emoryi* Torr., and in the lower hills and plains, where the woodlands contact the grasslands, *Juniperus monosperma* (Engelm.) Sarg. is more frequent, often forming savanna. Higher and cooler areas of the mountains have *Quercus hypoleucoides* A. Camus, *Q. arizonica* Sarg., *Q. rugosa* Nee, *Q. grisea* Liebm., *Q. depressipes* Trel., *Pinus cembroides* Zucc., *P. engelmannii* Carr., *P. chihuahuana* Engelm. and *Juniperus deppeana* Steud. Southeast of Cd. Chihuahua *Prosopis glandulosa* Torr. var. *torreyana* (L. Benson) I.M. Johnst., forms dense shrubby areas (mezquital), especially along roadsides and disturbed areas from Cd. Chihuahua to Estación Horcasitas, 25 km SW from Cd. Chihuahua (Anónimo 1981). Pressed and dried vouchers are stored in the herbarium CFNL; incomplete sets are deposited at ANSM, BRIT, MEXU, NMC and TEX (Holmgren & Holmgren 1990).

#### METHODS

During 1994–1998 numerous routes through all plant communities of the central part of the state of Chihuahua were sampled. On each site where legumes were collected, main vegetation type, geographic coordinates, nearest towns, altitude and slope were recorded. Nine hundred and fifty samples of legumes were collected in this study.

#### DISCUSSION

Only a partial geographical representation of legumes exist for Mexico. Regional studies have in particular contributed to the knowledge of these plants. Of particular merit are, for southern Mexico, Standley and Steyermark (1946), and Woodson et al. (1980); for central, Matuda (1980), and Rzedowski and Rzedowski (1979); for southwest, McVaugh (1987); for northeastern, Correll and Johnston (1970), Isely (1981), Estrada and Marroquin (1991), Carranza and Villarreal (1997), and Ramos (1999); for northwestern, Munz (1959), Kearney and Peebles (1960), Shreve and Wiggins (1964), Isely (1981), Spellenberg et al. (1996), and Estrada et al. (1997). These studies show distribution, diversity, and ecology of legumes in this country, while this research focuses on additional knowledge on presence, distribution and ecological aspects of the legumes in northern Mexico.

In this study, 42 genera, 117 species and 36 varieties of legumes from the central part of the state of Chihuahua were recorded. Lotoideae has the highest number of genera and species with 27 and 77 respectively, followed by Mimosoideae with 8 and 28 and Caesalpinioideae, with 7 and 12. Appendix 1 shows the taxa by family, and vegetation type(s) where they were more frequently found. *Dalea*, *Acacia*, *Desmodium* and *Phaseolus* are the most diverse genera, each with 5 or more species. These genera have species in the three main plant communities. *Dalea* is the genus with more species (19), nine of which occur in pine-oak forest, eight are dominant in grasslands, while six are



typical of matorral. The eleven species of *Acacia* mainly occur in plains and low sierras under 1700 m elevation, except for *A. angustissima* that grows in mountainous areas mainly associated to *Bouteloua* grasslands. *Acacia constricta* and *A. noevernicosa* are the dominant species in matorral communities. Five out of seven *Phaseolus* species are exclusive to pine oak-forest in the cooler parts of the region (Sierra El Nido and Majalca), above 1800 m elevation. All of *Desmodium* species occur in oak or pine forest, only *D. neomexicanum* occurs in the three dominant communities. None of the *Astragalus* species occurs in forest areas, while all of them occur in grassland communities. No species of Caesalpinoideae occur in pine or oak forest, the five species of *Senna* were seldom found in low numbers in matorral and grassland. Most *Mimosa* species were often associated with oak forests, in particular those formed by *Quercus emoryi* and *Q. grisea*, and matorral. In both communities, *M. aculeaticarpa* is the most abundant.

Highest number of legume species were recorded on oak-pine forests (33) and *Bouteloua* grasslands (31). Oak Forest and Pine Forest, each have a similar number of legume species, 21 and 20 respectively. In shrublands where *Acacia* is dominant, 25 species of legumes were recorded, three times the number of species recorded in *Larrea* and *Flourensia* shrubland. Within different grassland association, the *Sporobolus* and *Hilaria* types are areas with lowest legumes, with 9 and 6 species respectively, although they shelter some characteristic species from these plant communities such as *Hoffmanseggia* spp., *Astragalus* spp. and *Peteria scoparia*. Several species are found mainly in disturbed and overgrazed areas, they are *Acacia farnesiana*, *Mimosa aculeaticarpa* var. *biuncifera*, *Prosopis glandulosa* var. *torreyana*, *Acacia schaffneri* var. *bravoensis*, *Crotalaria pumila*, *Chamaecrista nictitans* and *Senna lindheimeriana*; the last three are found as roadside weeds. *Prosopis glandulosa* var. *torreyana* is one of the main species associated with median grassland (*Bouteloua* spp.) in central plains, especially in the area between Chihuahua-El Sueco and Chihuahua-Estación Horcasitas. *Acacia farnesiana* occurs throughout Mexico (Clarke et al. 1989), except for Chihuahua. In this study we found it occasionally in abandoned agricultural lands, close to human settlements and next to roads, around Cd. Aldama.

Eight legume species (7.5%) are introduced, *Caesalpinia gilliesii*, *Parkinsonia aculeata*, *Albizia julibrissin*, *Medicago sativa*, *Medicago lupulina*, *Lablab purpureus*, *Robinia pseudoacacia*, and *Wisteria sinensis*, the latter three are cultivated as ornamental plants. Eighty eight species are native of northern Mexico, some of them occur in southern U.S. From the approximately 135 genera and 1724 legume species present in Mexico (Sousa & Delgado 1993), 31.1% and 7.1% of them respectively are present in the study area. Grasslands and shrublands cover 95% of the studied area, but they have lower legume diversity than oak-pine forest, which represent only 5% of the surface. Total taxa recorded are distributed in a 7500 km<sup>2</sup> surface (lower than a tenth part of the state territory) on three main vegetal communities from the seven recognized for the state of Chihuahua (Anónimo 1978). A very different and heterogeneous relief, altitude, climate and vegetation association on the western part of the state of Chihuahua, reveal a constant legume species diversity, especially on cooler



oak, pine, oak-pine forests and subtropical shrublands. Spellenberg et al. (1996) list 30 genera and 65 legume species from Parque Nacional Cascada de Basaseachi; Estrada et al. (1997) list 21 genera and 53 species in Babicora Lake. Table 1 shows the affinities of legumes in the three studied areas. The most outstanding contrast in the areas is the presence of 14 genera in central Chihuahua, absent from Basaseachi and Babicora (*Desmanthus*, *Peteria*, *Painteria*, *Albizia*, *Prosopis*, *Zapoteca*, *Hoffmanseggia*, *Pomaria*, *Parkinsonia*, *Lablab*, *Melilotus*, *Nissolia*, *Pedimelum*, *Robinia*, and *Wisteria*), and seven genera in Basaseachi, absent from Babicora and Central Chihuahua, these are *Conzattia*, *Pithecellobium*, *Lysiloma*, typical of moist warm environments and *Erythrina*, *Lathyrus*, *Marina* and *Minkelpersia*. In Babicora no Caesalpinioideae occurs, while in Basaseachi, three species were found, all of which had tropical affinity. *Dalea* is conspicuously more abundant in the center of the state than in the other two areas, fourteen of the central species are absent in Babicora and Basaseachi. All of these are from semiarid climates. *Desmodium* is more diverse in Basaseachi, seven of its species, that are absent in the other two areas, are more common in moist environments. Perhaps the greater species diversity of legumes found for the central part of the state reflects the variation on climate, soil and topography of this region. These three factors are in sharp contrast in plains, sierras and mountains, and thus affect the distribution and abundance of different taxa.

TABLE 1. Subfamilies, genera and species of legumes in three regions of the state of Chihuahua.

|  | Basaseachi<br>Spellenberg et al. (1996) | Babicora<br>Estrada et al. (1997) | Central<br>Chihuahua |
|--|---|-----------------------------------|----------------------|
| Subfamilies                            | 3                                       | 2                                 | 3                    |
| Total genera                           | 30                                      | 22                                | 42                   |
| Total species                          | 65                                      | 53                                | 117                  |
| Genera/species                         |   |                                   |                      |
| Caesalpinioideae                       | 3/3                                     | 0                                 | 7/12                 |
| Genera/species                         |   |                                   |                      |
| Mimosoideae                            | 4/6                                     | 3/4                               | 8/28                 |
| Genera/species                         |   |                                   |                      |
| Lotoideae                              | 23/56                                   | 19/49                             | 27/77                |
| Genera exclusive to<br>the region      | 9                                       | 0                                 | 15                   |
| Genera with more<br>than three species | 7                                       | 5                                 | 11                   |
| Acacia species                         | 3                                       | 1                                 | 11                   |
| Dalea species                          | 7                                       | 9                                 | 19                   |
| Desmodium species                      | 14                                      | 8                                 | 6                    |
| Mimosa species                         | 0                                       | 1                                 | 5                    |
| Phaseolus species                      | 4                                       | 4                                 | 7                    |



## APPENDIX 1

Subfamilies, genera and species of legumes are recorded for the central part of the state of Chihuahua and plant communities where most frequently found. **HG**, *Hilaria* Grassland; **SG**, *Sporobolus* grassland; **BG**, *Bouteloua* grassland; **SL**, Shrubland (*Larrea* as dominant); **SF**, Shrubland (*Flourensia* as dominant); **SA**, Shrubland (*Acacia* as dominant); **SP**, Shrubland (*Parthenium* as dominant); **OF**, Oak forest; **OPF**, Oak-Pine forest; **PF**, Pine Forest; **D**, Disturbed Areas; **C**, Cultivated.

## MIMOSOIDEAE

- Acacia angustissima* (P. Miller) Kuntze. var. *chisosiana* Isely [**SA, SF, BG**]  
*Acacia angustissima* (P. Miller) Ktze. var. *texensis* (T. & G.) Isely [**SA, SL**]  
*Acacia berlandieri* Benth. [**SA**]  
*Acacia biaciculata* S. Wats. [**BG, HG, SG, SA**]  
*Acacia constricta* A. Gray [**SA**]  
*Acacia farnesiana* (L.) Willd. [**D**]  
*Acacia glandulifera* S. Wats. [**SA, SF**]  
*Acacia greggii* A. Gray var. *arizonica* Gray [**BG, SA, SP**]  
*Acacia greggii* Gray var. *greggii* [**SA, SP**]  
*Acacia neovernicosa* Isely [**SA, SF, SP, SL**]  
*Acacia roemeriana* Scheele [**SA**]  
*Acacia schaffneri* (Wats.) Herm. var. *bravoensis* Isely [**D, SA, SL**]  
*Acacia wrightii* Benth. [**SA**]  
*Albizia julibrissin* Durazz. [**C**]  
*Calliandra conferta* Gray [**SA, SL, SP, BG**]  
*Calliandra eriophylla* Benth. var. *eriophylla* [**SA, SL**]  
*Calliandra humilis* Benth. var. *reticulata* (A. Gray) L. Benson [**OF, OPF**]  
*Calliandra humilis* Benth. var. *humilis* [**OF, OPF**]  
*Desmanthus cooleyi* (Eat.) Trel. [**BG, SA, SL, OF**]  
*Desmanthus virgatus* (L.) Willd. [**BG, SA, SF**]  
*Mimosa aculeaticarpa* Ort. var. *biuncifera* (Benth.) Barneby [**D, SA, OF**]  
*Mimosa dysocarpa* Benth. [**BG, OF, OPF**]  
*Mimosa emoryana* Benth. var. *chihuahuana* (B. & R.) Barneby [**OF, SA**]  
*Mimosa emoryana* Benth. var. *emoryana* [**OF, SA**]  
*Mimosa pringlei* Wats. var. *pringlei* [**SA, OF**]  
*Mimosa texana* (Gray) Small var. *texana* [**SA, SF**]  
*Painteria elachistophylla* (Watson) Britton & Rose [**SA, SL**]  
*Painteria leptophylla* (DC.) Britton & Rose [**BG, OPF**]  
*Prosopis glandulosa* Torr. var. *torreyana* (L. Benson) M.C. Johnst. [**BG, SG, SA, SL, SF**]  
*Prosopis laevigata* (H. & B. ex Willd.) M.C. Johnst. [**SL**]  
*Prosopis pubescens* Benth. [**SL**]  
*Zapoteca media* (Mart. & Gal.) H. M. Hern. [**OF**]

## CAESALPINIOIDEAE

- Chamaecrista nictitans* (L.) Moench ssp. *nictitans* var. *mensalis* (Greenm.) Irwin & Barneby [**BG, D**]  
*Caesalpinia gilliesi* (Hook.) Benth. [**SG, C**]  
*Hoffmanseggia glauca* (Ort.) Eifert. [**BG, HG, SG**]  
*Parkinsonia aculeata* L. [**D**]  
*Pomaria jamesii* (T. & G.) Walp. [**HG, GS, BG**]  
*Pomaria multijuga* (S. Watson) B.B. Simpson [SA] (cited by Simpson 1998).  
*Senna bauhinoides* (Gray) Irwin & Barneby [**HG, SG, BG, SL, SF, SA**]  
*Senna lindheimeriana* (Scheele) Irwin & Barneby [**D, BG**]  
*Senna pilosior* (Macbride) Irwin & Barneby [**SP, SL**]  
*Senna ripleyana* (Irwin & Barneby) Irwin & Barneby [**SL, SF, BG**]  
*Senna wislizeni* (Gray) Irwin & Barneby var. *wislizeni* [**SL, SF, SA**]

## LOTOIDEAE

- Aeschynomene fascicularis* Schlecht. [**SA, BG**]  
*Astragalus allochorus* Gray var. *playanus* (Jones) Isely [**BG, D**]  
*Astragalus mollissimus* Torr. var. *earlei* (Greene ex Rydb.) Tidest. [**SG, HG, BG**]  
*Astragalus mollissimus* Torr. var. *irolanus* (Jones) Barneby [**BG, SG**]  
*Astragalus nuttalianus* A. DC. var. *austrinus* (Small) Barneby [**BG, HG, SA**]  
*Astragalus pringlei* Wats. [**BG, D, SA**]  
*Astragalus quinqueflorus* S. Wats. [**BG, HG**]  
*Astragalus wootonii* Sheld. [**D, BG, SA, SF**]  
*Cologania angustifolia* H.B.K. [**OPF, OPF**]  
*Cologania obovata* Schlecht. [**PF, PF**]  
*Coursetia caribaea* (Jacq.) Lavin var. *sericea* (Gray) Lavin [**OF, BG**]  
*Coursetia caribaea* (Jacq.) Lavin var. *caribaea* [**OF**]  
*Coursetia glabella* (Gray) Lavin [**OPF, PF**]  
*Crotalaria pumila* Ort. [**D, SA**]  
*Dalea brachystachya* Gray [**D, SL, SA**]  
*Dalea filiformis* Gray [**PF, OPF**]



- Dalea foliolosa* (Ait.) Barneby var. *foliolosa* [OPF, PF]  
*Dalea formosa* Torr. [SL, SA, SF, SP]  
*Dalea grayi* (Vail) L.O Williams [OPF, OF, PF]  
*Dalea humilis* G. Don. [PF, OPF]  
*Dalea jamesii* (Torrey) T. & G. [BG]  
*Dalea lachnostachya* Gray [SL, SA]  
*Dalea leporina* (Aiton) Bullock [BG, OPF, OF]  
*Dalea leucostachya* Wats. var. *leucostachya* [OF, OPF]  
*Dalea lutea* (Cav.) Willd. var. *lutea* [SA, OPF]  
*Dalea mollis* Benth. [BG]  
*Dalea nana* Torr. var. *carlescens* (Rydb.) K. & P. [BG SA]  
*Dalea neomexicana* (Gray) Cory var. *neomexicana* [BG]  
*Dalea pogonathera* Gray var. *pogonathera* [BG, SA, SF, SP, SG, HG]  
*Dalea prostrata* Ortega [BG]  
*Dalea versicolor* Zucc. var. *glabrescens* (Rydb.) Barneby [OPF, PF]  
*Dalea versicolor* Zucc. var. *sessilis* (Rydb.) Barneby [OPF, PF]  
*Dalea viridiflora* Wats. [OPF]  
*Dalea wrightii* Gray [BG]  
*Desmodium angustifolium* DC. [OF]  
*Desmodium batocaulon* Gray [OPF, PF]  
*Desmodium hartwegianum* Hemsl. var. *hartwegianum* [PF, OPF]  
*Desmodium neomexicanum* Gray [SA, OF, BG]  
*Desmodium grahamii* Gray [OF, BG]  
*Desmodium retinens* Schlecht. [OPF]  
*Eysenhardtia spinosa* Engelm. [SA, SP]  
*Galactia macreii* M.A. Curtis [OF]  
*Galactia wrightii* Gray [SA, D]  
*Indigofera montana* Rose [OPF, PF]  
*Indigofera ornithopodioides* Schlecht. & Cham. [SA, OF]  
*Lablab purpureus* (L.) Sweet [C]  
*Lotus greenii* (Woot. & Standl.) Ottley ex Kearney & Peebles [OPF, PF]  
*Lotus oroboides* (H.B.K.) Ottley ex Kearney & Peebles [OF, OPF]  
*Lotus plebeius* (Brandeg.) Barneby [PF]  
*Lupinus aff. delicatulus* Sprague & Riley [PF]  
*Lupinus ehrenbergii* Schlecht. [OF, OPF]  
*Macroptilium gibbosifolium* (Ort.) A. Delgado [BG, D, OPF]  
*Medicago sativa* L. [D, BG]  
*Medicago lupulina* L. [BG]  
*Melilotus indicus* (L.) All. [D]  
*Melilotus officinalis* L. [D]  
*Nissolia pringlei* Rose [SF, SA, SL, D]  
*Nissolia wislizeni* (Gray) Gray [SF, BG]  
*Pediomelum palmeri* (Ock.) Grimes [SG, BG]  
*Peteria scoparia* Gray [BG, SG, HG]  
*Phaseolus acutifolius* Gray [SA, OF]  
*Phaseolus angustissimus* Gray [BG]  
*Phaseolus grayanus* Woot. & Standl. [OF, OPF, PF]  
*Phaseolus leptostachyus* Benth. [OF, OPF, PF]  
*Phaseolus parvulus* Greene [OF, OPF, PF]  
*Phaseolus ritensis* Jones [OPF, OF]  
*Phaseolus vulgaris* L. [D]  
*Rhynchosia macrocarpa* Benth. [SA, OF, OPF]  
*Rhynchosia senna* Gill ex Hook. var. *angustifolia* (Gray) Grear [D, SA]  
*Robinia pseudoacacia* L. [D, C]  
*Sophora gypsophila* B.L. Turner & Powel [SG, SA, SF]  
*Tephrosia tenella* Gray [SA]  
*Trifolium amabile* H.B.K. var. *amabile* [OPF, PF]  
*Trifolium carolinianum* Michx. [OPF, PF]  
*Trifolium wormskioldii* Lehm. var. *ortegae* (Greene) Barneby [OPF, PF]  
*Vicia ludoviciana* Nutt. ssp. *ludoviciana* [OPF, PF]  
*Vicia pulchella* H.B.K. ssp. *pulchella* [OPF, PF]  
*Wisteria sinensis* (Sims.) Sweet [D, C]  
*Zornia gemella* (Willd.) Vog. [SA, OF, OPF]  
*Zornia reticulata* Sm. [OF, OPF]

## ACKNOWLEDGMENTS

We thank Alfonso Delgado and Fortunato Garza for comments on the manuscript and Richard Spellenberg, Emily Lott, Barney Lipscomb and Enrique Jurado for reviewing the English translation and critical reviews. Miguel Angel González provided the map.

## REFERENCES

- ANÓNIMO. 1978. Comisión técnico consultiva para la determinación de los coeficientes de agostadero. Guías para la determinación de condición. Secretaría de Agricultura y Recursos Hidráulicos.



- ANÓNIMO, 1981. Carta de uso de suelo y vegetación, escala 1: 1 000 000. Secretaría de Programación y Presupuesto. México, D.F.
- ANÓNIMO, 1981. Carta geológica, escala 1: 1 000 000. Secretaría de Programación y Presupuesto. México, D.F.
- ANÓNIMO, 1987. Mapa 1.2, Fisiografía, escala 1: 2 000 000. Instituto Nacional de Estadística Geografía e Informática, México, D.F.
- ACOSTA, J. A., J. M. MARTÍNEZ y F. CÁRDENAS. 1983. Distribución de las especies del género *Phaseolus* en el estado de Durango. Agric. Tec. Méx. 9 (1):13–22.
- BARNEBY, R. C. 1964. Atlas of North American *Astragalus*, part I-II, Mem. New York Bot. Gard. 13:1–1188.
- BARNEBY, R. C. 1977. Daleae Images. Mem. New York Bot. Gard. 27:1–879.
- BARNEBY, R. C. 1989. Intermountain flora. Fabales Vol 3 Part B. New York Bot. Gard. Pp. 11–279.
- BARNEBY, R. C. 1991. Sensitivae censitae. *Mimosa*. Mem. New York Bot. Gard. 65:1–835.
- BARNEBY, R. C. and J. GRIMES. 1996. Silk tree, Monkey's earring: A generic system for the synandrous Mimosaceae of the Americas. Part I. *Abarema*, *Albizia* and allies. Mem. New York Bot. Gard. 74:1–292.
- BARNEBY, R. C. and J. GRIMES. 1997. Silk tree, Monkey's earring: A generic system for the synandrous Mimosaceae of the Americas. Part II. *Pithecellobium*, *Cojoba* and *Zygia*. Mem. New York Bot. Gard. 74:1–149.
- BARNEBY, R. C. and J. GRIMES. 1998. Silk tree, Monkey's earring: A generic system for the synandrous Mimosaceae of the Americas. Part III. *Calliandra*. Mem. New York Bot. Gard. 74:1–223.
- BURKART, A. 1971. El género *Galactia* (Leguminosae–Phaseoleae) en Sudamérica con especial referencia a al Argentina y países vecinos Darwiniana 16:663–796.
- BURKART, A. 1976. A monograph of the genus *Prosopis* (Leguminosae, subfam. Mimosoideae) J. Arnold Arbor. 57:219–249.
- CARRANZA, M. A. & J. A. VILLARREAL. 1997. Leguminosas de Coahuila, México. U. A. A. N. Buenavista, Saltillo, Coah., México.
- CLARKE, D. and D. S. SEIGLER, and J. E. EBINGER. 1989. *Acacia farnesiana* (Fabaceae–Mimosoideae) and related species from Mexico, the southwestern U.S. and the Caribbean. Syst. Bot. 14:549–564.
- CLARKE, D., D. S. SEIGLER, and J. E. EBINGER. 1990. *Acacia constricta* (Fabaceae: Mimosoideae) and related species from the southwestern U.S. and Mexico. Amer. J. Bot. 77:305–315.
- CORRELL, D. S. and M. C. JOHNSTON. 1979. Manual of the vascular plants of Texas. Univ. Texas, Dallas. Pp. 761–889.
- CRONQUIST, A. 1988. The evolution and classification of flowering plants, 2nd. ed. New York Botanical Garden. Pp. 1–555.
- ELIAS, T. S. 1974. The genera of Mimosoideae (Leguminosae) in the southern United States. J. Arnold Arbor. 55:67–113.
- GARCÍA, E. 1973. Modificaciones al sistema de clasificación climática de Koeppen. 3a ed. Instituto de Geografía. Universidad Nacional Autónoma de México. D.F.



- GREAR, J. W. 1978. A revision of the New World species of *Rhynchosia* (Leguminosae - Faboideae). Mem. New York Bot. Gard. 31:1–168.
- GRIMES, J. 1990. A reivision of the New World species of Psoraleeae (Leguminosae: Papilionoideae). Mem. N. Y. Bot. Gard. 61:1–114.
- GUNN, C.R. 1979. Genus *Vicia* with notes about tribe Vicieae (Fabaceae) in Mexico and Central America. U.S.D.A. Tech. Bull. No. 1601.
- HERNÁNDEZ, H. 1986. *Zapoteca*: A new genus of noetropical Mimosoideae. Ann. Missouri. Bot. Gard. 73:755–763.
- HERNÁNDEZ, H. 1989. Systematics of *Zapoteca* (Leguminosae) Ann. Missouri. Bot. Gard. 76:781–862.
- HOLMGREN, P.C. and N.H. HOLMGREN. 1990. Index herbariorum, Ed. 8. Part 1. New York Botanical Garden.
- IRWIN, H.S and R.C. Barneby. 1982. The American Cassiinae. A synoptical revision of leguminosae tribe Cassiieae subtribe Cassiinae in the New World. Mem. New York. Bot. Gard. 35:1–918.
- ISELY, D. 1969. Legumes of the United States: I: Native *Acacia*. Sida 3:365–386.
- ISELY, D. 1973. Leguminosae of the United States: I. Subfamily Mimosoideae. Mem. New York. Bot. Gard. 25:1–152.
- ISELY, D. and F.J. Peabody. 1984. *Robinia* (Leguminosae: Papilionoideae): Castanea 49:187–202.
- ISELY, D. 1975. Leguminosae of the United States: II. Subfamily Caesalpinioideae. Mem. New York Bot. Gard. 25:1–228.
- ISELY, D. 1981. Leguminosae of the United States. III. Subfamiliy Papilionoideae: Tribes Sophoreae, Podalyrieae, Loteae. Mem. New York Bot. Gard. 25:1–264.
- JOHNSTON, M.C. 1962. The North American mesquites, *Prosopis* Sect. *Algarobia* (Leguminosae). Brittonia 14:72–90.
- KEARNEY, T. and R.H. Peebles. 1960. Arizona flora, 2nd. ed. Univ. Calif. Press.
- LAVIN, M. 1988. Systematic of *Coursetia* (Leguminosae-Papilionoideae). Syst. Bot. Monogr. 21:1–167.
- LESINS, K.A. and I. LESINS. 1979. Genus *Medicago* (Leguminosae). A taxogenetic study. W. Junk. The Hague-Boston-London.
- LUCKOW, M. 1993. Monograph of *Desmanthus* (Leguminosae–Mimosoideae). Syst. Bot. Monogr. 38:1–165.
- McVAUGH, R. 1987. Flora Novo-Galiciana. Vol. 5. Leguminosae.
- MARÉCHAL, R.J., J.M. MASCHERPA, and F. STAINIER. 1978. Étude taxonomique d'un groupe complexe dé espèces des genres *Phaseolus* et *Vigna* (Papilionaceae) sur la base de données morphologiques et polliniques, traitées par l'analyse informatique. Boissiera 28:1–273.
- MOHLENBROCK, R.H. 1961. A monograph of the leguminous genus *Zornia*. Webbia 16:1–141.
- MOHLENBROCK, R.H. 1962. Tribe Hedysareae, subtribe Stylosanthinae (Leguminosae) of Central America and Mexico. SouthW. Nat. 7:29–40.
- MUNZ, P.A. 1959. A California flora. University of California Press. Pp. 795–897.



- OTTLEY, A. M. 1944. The American Loti with special consideration of a proposed new section, *Simpeteria*. *Brittonia* 5:81–123.
- PIPER, B. C. 1926. Studies in American Phaseolineae. *Contr. U.S. Natl. Herb.* 22:663–701.
- PORTER, C. L. 1956. The genus *Peteria* (Leguminosae). *Rhodora* 58:344–354. Robertson, K.R. and Yin-Tse Lee. 1975. The genera of Caesalpinioideae (Leguminosae) in the Southeastern United States. *J. Arnold Arbor.* 57:1–53.
- RAMOS, M.C. 1999. Las Leguminosas de la Reserva El Cielo, Gómez Farías, Tamaulipas. Tesis. Instituto Tecnológico de Cd. Victoria, Tamaulipas.
- RUDD, V.E. 1956. A revision of the genus *Nissolia*. *Contr. U.S. Natl. Herb.* 32:173–206.
- RUDD, V.E. 1968. Leguminosae of Mexico. Faboideae I. Sophoreae and Podalarieae. *Rhodora* 70:493–532.
- RYDBERG, P. A. 1919. Fabaceae. In: *North Amer. Fl.* 24(1):1–250.
- RZEDOWSKI, J. 1978. Vegetación de México. Ed. Limusa. México, D.F.
- RZEDOWSKI, J. y G.C. DE RZEDOWSKI. 1979. Flora fanerogámica del Valle de México. CECSA. Pp. 279–354.
- RZEDOWSKI, J. 1988. Análisis de la distribución geográfica del complejo *Prosopis* (Leguminosae, Mimosoideae) en Norteamérica. *Acta Bot. Mex.* 3:7–19.
- SENN, H.A. 1939. North American species of *Crotalaria*. *Contr. Gray Herb.* 125:317–370.
- SHREVE, F. and I.L. WIGGINS. Vegetation and flora of the Sonoran Desert. Pp. 585–731.
- SHUBERT, B.G. 1940. I. *Desmodium*: Preliminary studies I. *Contr. Gray Herb.* 129:1–31.
- SHUBERT, B.G. 1941. II. *Desmodium*: Preliminary studies II. *Contr. Gray Herb.* 136:78–114.
- SIMPSON, B.B. 1998. A revision of *Pomaria* (Fabaceae) in North America. *Lundellia* 1:47–71.
- SMITH, C.P. 1938–1953. *Species Lupinorum* 1–768. en 44 fascículos, publicado por el autor.
- SOUSA, M. and A. DELGADO. 1993. Mexican Leguminosae: Phytogeography, endemism and origins In: *Biological diversity of Mexico: Origins and distribution*. Oxford Univ. Press. Pp. 459–507.
- SPELLENBERG, R., T. LEBGUE y R. CORRAL. 1996. Listados florísticos de México. XIII. A specimen-based annotated checklist of the vascular plants of Parque Nacional “Cascada de Basaseachi” and adjacent areas. Instituto de Biología. Universidad Nacional Autónoma de México.
- STANDLEY, P. C. 1922. Leguminosae. In: *Trees and shrubs of Mexico*. *Contr. U.S. Natl. Herb.* 23:348–515.
- STEVENSON, G.A. 1969. An agronomic and taxonomic review of the genus *Melilotus* Mill. *Canad. J. Pl. Sci.* 49:1–20.
- TURNER, B.L. 1950. Texas species of *Desmanthus*. *Field & Lab.* 18:54–65.
- TURNER, B.L. 1950. Mexican species of *Desmanthus* (Leguminosae). *Field & Lab.* 18:119–130.
- TURNER, B.L. and A.M. POWELL. 1972. A new gypsophilic *Sophora* (Leguminosae) from Northcentral Mexico and adjacent Texas. *Phytologia* 22:419–423.
- TURNER, B.L. 1992. Taxonomic overview of the genus *Cologania* (Fabaceae, Phaseoleae). *Phytologia* 73:281–301.
- ZOHARY, M. and D. HELLER. 1984. The genus *Trifolium*. The Israel Acad. Sci. Hum., Jerusalem.